Early Childhood Research Quarterly, 13, No., 2, 345–354 (1998)
ISSN: 0885-2006
© 1998 Ablex Publishing Corporation
All rights in any form reserved

Parent-Completed Developmental Questionnaires: Effectiveness with Low and Middle Income Parents

Jane K. Squires
LaWanda Potter
Diane D. Bricker
University of Oregon
Suzanne Lamorey
University of North Carolina at Charlotte

The Ages & Stages Questionnaires (ASQ) are a series of parent-completed questionnaires designed to screen the developmental performance of children from 4 through 48 months of age. This study examined the use of the ASQ with parents from low and middle income backgrounds. Ninety-six parents completed the ASQ on their child from 4 through 30 months. Percent agreement between questionnaires completed by parents in the low income sample ($N = 54$) and a professionally-administered standardized assessment ranged from .80-.91 ($X = .85$); percent agreement for questionnaires completed by parents in the middle income sample ($N = 42$) ranged from .85-.93 ($X = .89$). In this longitudinal study, both middle and low income parents appeared able to complete developmental questionnaires with reasonable accuracy.

Research on the importance of early identification of developmental problems as well as federal mandates provide strong impetus for the establishment of large scale child find systems (Guralnick, 1997). Many state agencies are attempting to develop such systems; however, a major barrier has been the availability of low-cost screening tools for infants and young children that also have acceptable validity and reliability. A promising approach to meet the dual criteria of low cost and accurate outcomes (i.e., reliably identifying children whose development is questionable) has been the development of screening tools designed to be completed by parents (Long, 1992; Squires, Nickel, & Eisert, 1996).

Direct all correspondence to: Jane K. Squires, Early Intervention Program, 5253 University of Oregon, Eugene, OR 97403-5253 <Jane_Squires@ccmail.uoregon.edu>.

Although screening tools for use by parents clearly address the cost criteria, a general concern has been raised about parental ability to reliably and accurately assess their children's developmental status (Sheehan, 1988). This concern has generated a series of investigations in which parental assessment of their children has been compared with an assessment conducted by professionals. Investigators consistently report substantial agreement between parental and professional assessments when parents are asked to assess *current, observable* child behavior (Dale, Bates, Reznick, & Morisset, 1989; Fenson, Dale, Reznick, Bates, Thal, & Pethick, 1994; Saylor, Foster, & Huntington, 1991; Squires, Bricker, & Potter, 1997).

An associated concern has been whether accurate assessment of child behavior is dependent on parents having certain characteristics. Specifically, can parents from low income backgrounds assess their children as reliably as parents from higher income backgrounds? Previous comparisons have produced conflicting results (Frankenburg, Coons, & Ker, 1982; Knobloch, Stevens, Malone, Ellison, & Risemberg, 1979; Rescorla, 1989). Clearly for screening tools to meet the criteria of low cost and accurate outcomes, they must be appropriate for parents from a range of socio-economic conditions and income levels. It is particularly important that parent-completed screening tools be appropriate for children and parents from low income backgrounds, as these children are at increased risk for developmental and academic problems (Chafel, 1997; Future of Children, 1997).

To address this important question, a longitudinal study was undertaken to compare the "accuracy" of parents from low and middle income backgrounds. Parents completed a series of developmental questionnaires for children, the Ages and Stages Questionnaires (ASQ) (Bricker, Squires, & Mounts, 1995). Within two weeks of completing the ASQ at 12, 24, and 30 months, children were administered a standardized professionally-administered assessment (i.e., Bayley Scales of Infant Development). "Accuracy" in this study was determined by comparing agreement between classifications of children on the parent-completed developmental questionnaires (i.e., risk, OK) and the professionally-administered assessment (i.e., risk, OK) for each income level.

The ASQ (Bricker, Squires, & Mounts, 1995), formerly called the Infant/Child Monitoring Questionnaires, are a series of 11 questionnaires designed to be completed by parents when their infant/child is 4, 6, 8, 12, 16, 18, 20, 24, 30, 36, and 48 months of age (with the date of birth corrected for prematurity for children from birth through 24 months). Each questionnaire contains 30 simply-worded items written at a 4th to 6th grade reading level, equally divided across the areas of communication, fine motor, gross motor, personal-social, and problem solving skills.

Items on each of the 11 questionnaires represent behaviors that children at that age should be able to perform (i.e., a developmental quotient range of 75-100). Parents are asked to observe their child completing these specific activities and then to report on their child's performance. Parents answer "yes," "sometimes," and "not yet" according to whether their child can do the activities, such as sit up with support (8 month ASQ); use 8 words (16 month ASQ); dress or undress self (48 month ASQ). This recognition format has been found to facilitate gathering of

	YES	SOMETIMES	NOT YET	
FINE MOTOR *Be sure to try each activity with your child.*				
1. Does your baby reach for a crumb or Cheerio and touch it with her finger or hand? (If she already picks up a small object, check "yes" for this item.)	❑	❑	❑	___
2. Does your baby pick up a small toy, holding it in the center of his hand with his fingers around it?	❑	❑	❑	___
PROBLEM SOLVING *Be sure to try each activity with your child.*				
3. Does your baby play by banging a toy up and down against the floor or table?	❑	❑	❑	___
4. Does your baby pass a toy back and forth from one hand to the other?	❑	❑	❑	___
PERSONAL-SOCIAL *Be sure to try each activity with your child.*				
1. While lying on her back, does your baby play by grabbing her foot?	❑	❑	❑	___

Figure 1. Samle items from the 8-month Ages & Stages Questionnaire

accurate information, rather than simply asking parents to recall what their child has done sometime in the past (Dale et al., 1989; Diamond & Squires, 1993; Fenson et al., 1994). Sample items from the 8 month ASQ are contained in Figure 1.

The ASQ scoring system is as follows: 10 points for "yes," 5 for "sometimes," and 0 for "not yet." Questionnaires are scored by totaling the domain scores for the questionnaires and comparing each domain score with the screening cutoff score for that domain. These cutoff scores are two standard deviations below the mean domain score, based on over 8,000 questionnaires, and vary by age interval. If the child's score falls at or below the established cutoff score in one or more domains, the child's performance for that questionnaires is classified as "risk" and it is recommended that the child be referred for further assessment.

The psychometric properties of the ASQ including concurrent validity, test-retest reliability, and inter-rater reliability, have been studied at the University of Oregon for over 15 years (Bricker & Squires, 1989a; 1989b; Squires, Potter, & Bricker, 1997). Test-retest reliability, or comparison of scores of two questionnaires completed by parents (N = 175) at a two-week interval, was found to be 94%. Interobserver reliability, or comparison of childrens' classifications based on questionnaires completed by parents (N = 112) and professional examiners (N = 2), was also 94%. Concurrent validity, reported as percent agreement between classifications (i.e., risk, OK) on questionnaires and standardized assessments, ranged

from 76% for the 4-month ASQ to 91% for the 36-month ASQ, with 88% agreement overall. Sensitivity, or the ability of the ASQ to detect delayed development, ranged from 51% for the 4-month ASQ to 90% for the 36-month ASQ, with a 75% overall sensitivity rate. Specificity, or the ability of the ASQ to correctly identify typically developing children, ranged from 81% for the 16-month ASQ, to 92% for the 36-month ASQ, with an overall specificity rate of 86%.

Aim

The present study was undertaken to investigate the effectiveness of the ASQ with families from low income backgrounds. A longitudinal study was conducted to investigate changes in parent accuracy and child developmental status over time.

METHOD

Sample

A sample of 96 parent-infant dyads was recruited and assigned to income groups. Families with incomes below the federal guidelines of 100% poverty level were assigned to the low income group. Families with incomes above the poverty level comprised the middle income group; no upper income families participated. Table 1 summarizes demographic characteristics of these families. Dyads were recruited through birth announcements in the newspaper, in public health clinics, hospitals, public housing projects, teen parent programs, and migrant worker sites in four major cities in Oregon.

Procedure

Once the project was explained and informed consent was obtained, parents in both groups (low and middle) completed the ASQ in their homes when their child was 4, 8, 12, 16, 20, 24, 30, and 36 months old. Parents received each questionnaire in the mail with a cover sheet summarizing the study and asking them to complete the ASQ and return it within two weeks. Parents were encouraged to try ASQ items with their child before answering each question. Postage and mailing envelopes were provided and reminder telephone calls were given to parents if questionnaires were not returned within 10 days. In addition, within 2 weeks of completing the ASQ at 12, 24, and 30 months, parents brought their child to a central location for a standardized assessment using the Bayley Scales of Infant Development (Bayley, 1969). As an incentive, parents in the low income group received $10 each time they completed a questionnaire and $25 for participating in the center-based assessment. Parents in the middle income group did not receive any incentive payments. The center-based assessments were completed by one of two child development specialists who were trained by a licensed psychologist to administer the Bayley. Reliability between the two assessors was established at >.90 at each test interval.

Table 1. Demographic Profile of Parent-Infant Dyads

	Income Status	
	Low (N = 54)	Middle (N = 42)
Maternal Age at Infant's Birth		
15 to 19 years	16	0
20 to 29 years	26	32
30 to 39 years	8	10
Missing data	4	0
Highest Level of Maternal Education		
Graduate Professional Training	0	4
College Degree	1	10
Partial College	9	17
High School Degree	15	8
Less than High School Degree	25	0
Missing data	4	3
Ethnicity of Infant		
Caucasian	23	36
African-American	8	1
Hispanic	8	2
Native American	4	1
Other	3	0
Missing data	5	2
Annual Income Level (1994)		
Under $5,000	16	0
$5,000-$10,000	17	0
$10,000-$15,000	13	0
$15,000-$20,000	5	8
$20,000-$30,000	32	19
Over $30,000	0	12
Missing data	0	33

The child's performance on the Bayley was classified as "risk" if the scaled score was equal to or less than 76 (1.5 standard deviations below the mean) on either the psychomotor (PDI) or mental index (MDI). The child's performance on the ASQ was classified as "risk" if the child scored at or below empirically-derived cutoff points for each questionnaire interval (i.e., 2 standard deviations below the mean in any of the five domains) (Squires, Potter, & Bricker, 1995). Percent agreement between classifications on the Bayley (risk, OK) and on the ASQ (risk, OK) were compared for income groups. Over-referral rates (i.e., false positives—those who were identified as "risk" on the ASQ and "OK" on the Bayley) and under-referral rates (i.e., false negatives—those who were identified as "risk" on the Bayley and "OK" on the ASQ) were calculated, as well as sensitivity and specificity.

RESULTS

Eleven dyads in the low income sample and 16 dyads in the middle income sample discontinued participation between the 12- and 30-month assessments, resulting in an attrition rate of 28%. Chi-square Tests of Association indicated that subjects who left the study were not over-represented in any levels of ethnicity, education, or income, suggesting that parents who left the study were similar to those who participated on these variables. Because of this high attrition rate, however, longitudinal analyses regarding changes in parent accuracy and developmental status could not be conducted.

Percent agreement, sensitivity, specificity, over-referral, and under-referral rates of the ASQ completed by parents in the low and middle income groups are shown in Table 2. Percent agreement between the parent-completed ASQ and the professionally-administered Bayley was calculated by dividing the sum of the true positives (i.e., those children identified by the ASQ and Bayley as "risk") and true negatives (i.e., those children identified as "OK" by the ASQ and Bayley) by the sum of the true positives, false positives (i.e., those children identified as "risk" by the ASQ but OK by the Bayley), false negatives (i.e., those children identified as "OK" by the ASQ but as "risk" by the Bayley), and true negatives. Percent agreement for parents in the low income group remained high across test intervals (.91 at 12 months, .80 at 24 months, and .84 at 30 months). Likewise, percent agreement for parents in the middle income group remained consistently high (.93 at 12 months, .84 at 24 months, and .89 at 30 months).

Differences in accuracy (i.e., percent agreement between parent-completed screening results and professional assessments) between low and middle income parents were examined using the test for significance between two proportions (Bruning & Kintz, 1987). No statistically significant differences were found at 12, 24, or 30 months, indicating parents in both groups were able to supply developmental information about their children with acceptable accuracy.

While it was not possible to use inferential statistics because expected cell frequencies were too small, specificity, sensitivity, over-identification, and under-identification rates were computed and compared. Specificity—calculated by dividing the true negatives by the sum of the false positives and true negatives—reflects the ability of a test to accurately discriminate those children who do not have a potential problem from those who do. Specificity for the ASQ was .85 (n = 125/147) for the low income group and .89 (n = 89/100) for the middle income group. Sensitivity, or the ability of a screening test to accurately discriminate those children who have potential developmental problems, was calculated by dividing the true positives by the sum of the true positives and false negatives. Sensitivity was difficult to evaluate in this study, however, because few of the children ($N = 7$ at all age intervals) were given "risk" classifications on both the Bayley and ASQ. Under-referral—calculated by dividing the false negatives by the sum of the true positives, false positives, false negatives, and true negatives—ranged from 0-5%. Over-referral—calculated by dividing the false positives by the sum of the true positives, false positives, false negatives, and true negatives—ranged from 6-20%.

Table 2. Sensitivity, Specificity, Under-Referral, Over-Referral and Percent Agreement at Each Assessment Interval Using the Bayley Scales Of Infant Development and the Ages & Stages Questionnaires for Low and Middle Income Parent-Infant Dyads

Assessment Interval	Total N	Sensitivity		Specificity		Under-Referral		Over-Referral		Percent Agreement	
		N	%	N	%	N	%	N	%	N	%
12 Month											
Low Income	54	1/2	50	48/51	94	2/54	4	3/54	6	49/54	91
Middle Income	42	1/1	100	38/41	93	0/42	0	3/42	7	39/42	93
24 Month											
Low Income	50	0/0	0	40/50	80	0/50	0	10/50	20	40/50	80
Middle Income	32	1/1	100	26/31	84	0/32	0	5/32	16	27/32	84
30 Month											
Low Income	43	1/3	33	35/40	87	2/43	5	5/43	12	36/43	84
Middle Income	26	0/0	0	23/26	89	0/26	0	3/26	12	23/26	89

DISCUSSION

Hypotheses relating to parental socio-economic status and completion of developmental questionnaires were addressed. The findings from this study concurred with findings of Knobloch et al. (1979) that parents from low income backgrounds were able to accurately complete developmental questionnaires on their infants and young children. If the professional's evaluation is used as the standard, parents from both low and middle income groups were able to supply accurate developmental information about their children when asked to make judgments about current, observable behaviors. These results support the use of parent-completed screening questionnaires with a broad range of parents and children.

Sensitivity of the ASQ was difficult to evaluate because of small numbers in certain cells; however specificity was high. Under-referral rates were low (0-5%) while over-referral rates were higher (6-20%). These higher over-referral rates are perhaps acceptable in a screening tool because they reduce the likelihood of "missing" children who are in need of further evaluation and intervention services.

An additional limitation was the large rate of attrition in this study. A self-selected group of parents who were motivated to answer questionnaires and participate in a center-based assessment remained at 30 months. In addition, this group of parents may have become sensitized to developmental issues over time by completing repeated ASQ and Bayley assessments. Nearly one-third (29%) in the low income group and over one-third (38%) in the middle income group dropped from the study during the 30 month duration. In future studies, a larger sum of incentive money for both low and middle income parents is suggested to decrease attrition rates.

Implications for Practice

Developmental questionnaires completed by parents may be a useful tool for practitioners in early childhood settings. Often early childhood teachers are concerned about a young child's development and are faced with the challenge of communicating these concerns with parents. Asking parents to complete a screening questionnaire in the home environment may alert parents to problem areas and provide a common ground from which parents and teachers may discuss concerns and future steps. The reverse may also occur—the parent may have a concern which the teacher does not share. Having both the teacher and parent complete a screening questionnaire again may provide a common base from which to discuss problem areas and highlight children's differences and similarities in behaviors across settings. In addition, early childhood practitioners and parents may gain an increased understanding of the developmental repertoire of a young child by completing questionnaires and discussing results. Additional questionnaires for language (Rescorla, 1989; Fenson, Pethick, & Cox, 1993) and general development (Ireton, 1992; Ireton, Diamond, & Carney, 1993) can assist in screening and identifying young children with special needs in early childhood settings, using valuable input from parents, home visitors, and teachers.

As the number of dollars shrink and as the population of high-risk infants grows (Widerstrom, Mowder, & Sandall, 1997), it is increasingly urgent to find cost-effective methods for identifying infants and young children in need of early intervention services. To be able to involve parents as developmental screeners, no matter what their circumstances or background, is a promising option.

Acknowledgments: Support for this project was provided by the National Institute on Disabilities and Rehabilitation Research, U.S. Department of Education (#H1336600122) and the March of Dimes Research Foundation (#12-206). Appreciation is extended to Craig Leve for data analysis.

NOTES

1. Large family size contributed to low income status of these families.
2. While these families did not want to disclose amount of annual income, they did specify whether their income was above or below 100% of federal poverty level.

REFERENCES

Bayley, N. (1969). *Bayley scales of infant development.* New York: The Psychological Corporation.

Bricker, D., & Squires, J. (1989a). The effectiveness of screening at-risk infants: Infant monitoring questionnaire. *Topics in Early Childhood Special Education, 9*(3), 67-85.

Bricker, D., & Squires, J. (1989b). A low-cost system using parents to monitor the development of at-risk infants. *Journal of Early Intervention, 1*(13), 50-60.

Bricker, D., Squires, J., & Mounts, L. (1995). *Ages and stages questionnaires: A parent-completed, child-monitoring system.* Baltimore, MD: Brookes.

Bruning, J., & Kintz, B. (1987). *Computational handbook of statistics*, 3rd ed.) Glenview, IL: Scott, Foresman.

Chafel, J. (1997). Schooling, the hidden curriculum, and children's conceptions of poverty. *Social Policy Report, 11*(1), 1-18. Ann Arbor: Society for Research in Child Development.

Dale, P., Bates, E., Reznick, S., & Morisset, C. (1989). The validity of a parent report instrument of child language at twenty months. *Journal of Childhood Language, 16*, 239-249.

Diamond, K., & Squires, J. (1993). The role of parental report in the screening and assessment of young children. *Journal of Early Intervention, 17*(2), 107-115.

Fenson, L., Dale, P., Reznick, J., Bates, E., Thal, D., & Pethick, S. (1994). Variability in early communicative development. *Monographs of the Society for Research in Child Development. Serial No. 242, 59*(5).

Fenson, L., Pethick, S., & Cox, J. (1993). *MacArthur short form vocabulary checklist.* San Diego, CA: San Diego Developmental Psychology Lab.

Frankenburg, W., Coons, C., & Ker, C. (1982). Screening infants and preschoolers to identify school learning problems. In E. Edgar, N. Haring, J. Jenkins, & C. Pious (Eds.), *Mentally handicapped children.* Baltimore, MD: University Park Press.

Future of Children. (1997). *Children and poverty.* Los Altos, CA: Center for Future of Children/ David and Lucille Packard Foundation.

Guralnick, M. (1997). *The effectiveness of early intervention.* Baltimore, MD: Brookes.

Ireton, H. (1992). *Child development inventories.* Minneapolis, MN: Behavior Science Systems.

Ireton, H., Diamond, G., & Carney, J. (1993). Preschool screening using the parent's preschool development inventory report. *Diagnostique, 18*(4), 270-281.

Knobloch, H., Stevens, F., Malone, A., Ellison, P., & Risemberg, H. (1979). The validity of parental reporting of infant development. *Pediatrics, 63*, 873-878.

Long, M. (1992). The use of parent report measures to assess infant development. *Pediatric Physical Therapy*, *4*(2), 74-77.

Rescorla, L. (1989) The language development survey: A screening tool for delayed language in toddlers. *Journal of Speech and Hearing Disorders*, *54*, 587-599.

Saylor, C., Foster, K., & Huntington, L. (1991, November). *Predictive and concurrent validity of two measures of development with premature infants*. Paper presented at the International Early Childhood with Special Needs, St. Louis, MO.

Sheehan, R. (1988). Involvement of parents in early childhood assessment. In T. Wachs & R. Sheehan (Eds.), *Assessment of young developmentally disabled children* (pp. 75-90). NY: Plenum.

Squires, J., Bricker, D., & Potter, L. (1997). Revision of a parent-completed developmental screening tool: Ages and stages questionnaires. *Journal of Pediatric Psychology*, *22*(3), 313-328.

Squires, J., Nickel, R., & Eisert, D. (1996). Early detection of developmental problems: Strategies for monitoring young children in the practice setting. *Developmental and Behavioral Pediatrics*, *17*(6), 1-8.

Squires, J., Potter, L., & Bricker, D. (1995). *The ASQ user's guide*. Baltimore, MD: Brookes.

Widerstrom, A., Mowder, B., & Sandall, S. (1997). *Infant development and risk*, 2nd ed. Baltimore, MD: Brookes.